

Upper Mississippi River Nine-Foot Channel Project,
Lock and Dam No. 24
Clarksville, Missouri
Pike County, Missouri
Calhoun County, Illinois

HAER No. MO-36

HAER
MO,
82-CLAVI,
2-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Rocky Mountain Regional Office
National Park Service
U. S. Department of the Interior
P.O. Box 25287
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD

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Location: The site is located on the Mississippi River at Clarksville, Missouri, 93.5 miles upstream from St. Louis and 273.5 miles above the mouth of the Ohio River. The lock is located close to the Missouri shore at the base of a high, steep hill. The river in this location is normally approximately 1,650 feet wide, but during high water it inundates the flood plains along the Illinois shore as far as the levee of the Sny Island Drainage & Levee District, approximately 3,800 feet from the Missouri bank of the river. The natural channel crosses to the Illinois side of the river, a short distance above the lock and dam complex, then recrosses to the Missouri side, just below the site.

Date of Construction: 1936-1940

Architect/Engineer: U. S. Army Corps of Engineers

Builders: Central Engineering Company, Davenport, Iowa

Present Owner: U. S. Government (St. Louis District, U.S. Army Corps of Engineers)

Present Use: River navigation and control

Significance: The Upper Mississippi River Nine-Foot Channel Project represents one of the largest and most ambitious river improvement projects ever constructed in the United States. The project's origins date to the 1920s and the efforts of Upper Midwest commercial interests to improve their access to markets. During the early years of the Great Depression, the project became transformed into a massive public works program intended to relieve local and regional unemployment.

The locks and dams that comprise the project constitute seminal developments in the technological history of American river navigation projects. The project pioneered the use of non-navigable movable dams in the United States. Designers and engineers from the U.S. Army Corps of Engineers committed themselves to a foreign technology, by their decision to incorporate roller gates into the majority of the project's dams and, more importantly, developed new and improved versions of the simpler and more reliable Tainter gate at such a rapid rate that, by the end of the 1930s, roller gates had become a passe' technology.

The successful completion of the Nine-Foot Channel Project transformed the Upper Mississippi River into an intra-continental canal, providing a fully navigable interior river system throughout the Midwest. The project significantly altered the environment of the Upper Mississippi, but it also served as an impetus for the improvement of drinking water and sewage disposal systems in towns and cities located along the river. Additionally, the project provided new recreational opportunities to the general public.

Historian: Patrick W. O'Bannon, July 1989

PART 1. HISTORICAL INFORMATION

A. Physical History

1. Dates of Erection: 1936-1940
2. Architect-Engineer: U. S. Army Corps of Engineers
3. Original and Subsequent Owners: U. S. Government
4. Builders, Contractors, Suppliers
 - a. General Contractor -- lock construction: Central Engineering Company, Davenport, Iowa
 - b. Subcontractors -- lock construction: American Bridge Company (structural steel and miscellaneous iron), Sammons, Robertson & Henry Company (common excavation), Tri-State Dredging Company (dredging), Missouri Gravel Company (concrete aggregate), Universal Atlas Cement Company (cement), H. E. Pederson (erection of reinforcing and conduit), Inland Steel Company (steel sheet piling), Crane Company (iron and steel pipe), W. T. Ferguson Lumber Company (permanent timber), Midwest Engineering Company (concrete sewer pipe), Graybar Electric Company (fiber conduit), Crescent Electric Company (metal conduit), Oberjuerge Rubber Distributing Company (rubberized fabric seals for stop logs), Arketex Corporation (gauge tiles), Union Metal Manufacturing Company (lighting unit poles and bases).
 - c. General Contractor -- dam construction: Central Engineering Company, Davenport, Iowa.
 - d. Subcontractors -- dam construction: R. C. Mahon Company (structural steel and miscellaneous iron, Tainter gate operating machinery), Carnegie-Illinois Steel Company (Cor-Ten phosphor-chromium steel for Tainter gates).
 - e. General Contractor -- power, control, and lighting: Commonwealth Electric Company, St. Louis, Missouri.
5. Original Plans and Construction: U.S. Army Corps of Engineers

Upper Mississippi River Nine-Foot Channel Project,
Lock and Dam No. 24
HAER No. MO-36
(Page 3)

6. Alterations and Additions:

<u>Item</u>	<u>Year</u>
Provision of signage atop dam	1939
Provision of security lighting	1942
Shelter constructed atop Dam Pier No. 1	1940
Storage building erected in storage yard	1943
Housings provided for Tainter valve operating machinery recesses	1946
Provision of handrails on lockwalls	1948
Small boat signal installed	1950
Esplanade parking areas reconfigured	1953
Observation deck constructed	1958
Lockman's shelters constructed on lock walls	1958
Shop building constructed	1959
Maintenance building constructed	1961
Lock gates and Tainter Valve No. 1 altered	1965
Floating mooring bits installed in lock walls	1970
Tow haulage units replaced by Lake Shore, Inc., Iron Mountain, Minnesota	1971
Selected members replaced on Tainter gates 1, 2, 4, 6, 7, 11, and 12	1975
Lock Gate No. 2 replaced	1975
Central control station balcony framed in, ceilings insulated and suspended	1976
Stone protection at lock and dam repaired	1978
Motorboats installed on davits at upper and lower ends of intermediate wall	1980
Closure dike constructed above auxiliary lock gates	1981
Lock Gate Nos. 2 and 4 replaced	1981
Tainter valves rehabilitated	1983
Rail-mounted traveling check posts installed along lock's land wall	1985
Replaced back shaft pinion gears for miter gate operating machinery	1986
Began dam concrete repairs at Tainter gate trunnions	1987
Began construction of an addition and rehabilitation of the central control station	1987
Dike tops concreted	1988
Installed new bottom seal on Tainter Gates Nos. 6-10	1988
Construct lock bulkhead recesses, eliminating need for poiree dams at upper lock gates	1988
Levee above lock repaired by McMenamy Construction Company	1984

B. Historical Context

Lock and Dam No. 24 was the last installation within the Corps of Engineers' St. Louis District designed and completed under the upper Mississippi River Nine-Foot Channel Project. Construction began on the main lock in July 1936. The installation was placed in operation in March 1940.

The installation consists of a main lock, located against the Missouri shore, the upper gate bay section of an auxiliary lock, a 1,340-foot-long movable dam, a storage yard located adjacent to the Illinois abutment of the movable dam, and a submersible earth dike, 2,720 feet in length, extending to the Illinois shore.

Lock No. 24 is founded on durable shale, unlike the locks previously constructed in the St. Louis District (Lock Nos. 25 and 26), which are pile-founded structures built atop the sand and gravel of the river bottom. Because of the presence of a firm foundation material, the lock chamber is not floored and no lateral struts were provided to stabilize the intermediate and river walls.

The lock conforms to standard specifications for the Upper Mississippi River Nine-Foot Channel Project. The lock chamber measures 110 feet in width and 600 feet in length. The average lift is 15 feet. The land wall measures 1,941 feet in length, the intermediate wall measures 907 feet, and the river wall measures 794 feet. The lock is flooded and emptied by means of culverts located in the base of the land and intermediate walls. The culverts are square in section, measuring 12 feet 6 inches by 12 feet 6 inches. Small ports in the lock walls permit water to enter and leave the lock chamber. Four electrically-operated Tainter valves, located in the lock walls, control the flow of water in the culverts.

The movable portion of the dam is comprised of 15 submergible, elliptical Tainter gates, each measuring 80 feet in width and 25 feet in height. The gates are constructed of phosphor-chromium steel and represent the apex of gate design achieved during the Nine-Foot Channel Project. The gates are raised and lowered by individual electric motors, connected by line shafting to line-chain hoists, located beneath the dam service bridge.

The dam piers also represent the culmination of the engineering advances made during the course of the Nine-Foot Channel Project. The individual piers provide support for both the Tainter gates and the steel deck girder service bridge that extends the entire length of the dam while utilizing a minimum amount of concrete and steel reinforcing.

PART 11. TECHNOLOGICAL INFORMATION -- LOCK

A. General Statement:

1. Architectural character: Standardized Ohio-Mississippi lock design. Drawing M-L 24/1.
2. Condition of fabric: Good.

B. Description of General Layout and Principal Elements:

1. Overall dimensions: 110 feet by 600 feet. Drawing M-L 24/1.
2. Foundations: Shale. Drawing M-L 24/1.
3. Walls: Monolithic reinforced concrete with steel wall armor. Drawing M-L 25 20/1.
4. Structural system: Monolithic reinforced concrete.
5. Bullnoses: Concrete bullnoses with steel wall armor at each end of intermediate wall.
6. Upper and lower guide walls: Monolithic reinforced concrete construction, extensions to land wall, located above and below the lock chamber to assist in guiding traffic into the chamber.

C. Mechanical Equipment:

1. Lockmen's shelters: Operating controls for lock gates and Tainter valves housed in small buildings on land and intermediate walls.
2. Tainter valves: Four electrically-operated, cable-driven steel Tainter valves located in upper and lower ends of land and intermediate lock walls. Drawings M-L 24 25/1 and M-L 24 28/0.
3. Lock Gates: Miter gates: Two two-leaf Miter gates balanced on stainless steel pintels. Gates are electrically operated by means of steel sector gears and struts. Motor assemblies housed in machinery pits located in lock walls adjacent to each gate leaf. Oak timber fenders on gate faces. Upstream gates in main lock are 25 feet tall. Downstream gates are 33 feet tall. An additional set of 30-foot-tall gates, without operating machinery, are located at the upper gate bay of the uncompleted auxiliary lock. Drawings M-L 24 21/1, M-L 24 21/24, M-L 24 22/1.
4. Lighting: Various free-standing single- and double-head lighting standards. Heads replaced ca. 1982. Drawing M-L 24 29/29.
5. Plumbing: Lock chambers are watered by means of longitudinal culverts located in lock walls. Culverts measure 12 feet 6 inches square in section. Tainter valves (described above) control the flow of water in the culverts. Drawings M-L 24 20/1, M-L 24 22/1.
6. Tow haulage unit: Motorized winch assembly used to assist movement of barges through the lock chambers.

D. Other Elements:

1. Auxiliary lock: Fixed 32-foot miter gates without operating machinery located between lock and movable dam. Equipped with wells for miter gate and Tainter valve operating

machinery. Never completed or placed in service. Closure dike constructed above miter gates in 1981. Drawings M-L 24 20/1.

PART III. TECHNOLOGICAL INFORMATION -- MOVABLE DAM

A. General Statement:

1. Architectural character: Type 2 structure without pier houses. M-L 24 40/1.
2. Condition of fabric: Good

B. Description of Exterior:

1. Overall dimensions: 1,460 feet in length. Drawing M-L 24 40/1.
2. Foundations: Wood and steel sheet piling in sand.
3. Tainter gate piers: Monolithic reinforced concrete construction. Drawing M-L 24 40/12.
4. Structural system: Monolithic reinforced concrete construction encompassing piers, gate
5. Openings: Pier No. 1 contains an original doorway and two six-light industrial sash windows. This shelter contains one doorway, four three-light window sash, and three six-light sash. Pier No. 17 contains two doorways and seven six-light industrial sash windows. M-L 24 40/1.
 - a. Doorways and doors: 4
 - b. Windows: 16
6. Roofs:
 - a. Pier No. 1:
 1. Shape, covering: Low gabled metal roof.
 - b. Pier No. 17:
 1. Shape, covering: Flat slag roof.
7. Service bridge:
 - a. Shape: Deck girder. Drawing M-L 24 40/1.
 - b. Materials: Structural steel

C. Description of General Layout and Principal Elements:

1. Access plans: Access provided by poured concrete stairways located within Piers Nos. 1 and 17. Service bridge provides access across top of movable dam. Drawing M-L 24 40/1.
2. Stairways: Structural steel/poured concrete.
3. Flooring: Reinforced concrete.
4. Wall and ceiling finish: Reinforced concrete
5. Hardware: Brass

D. Mechanical Equipment:

1. Movable gates -- Tainter type: Fifteen submersible, elliptical Tainter gates, each measuring 80 feet by 25 feet. Constructed of Cor-Ten phosphor-chromium steel. Gates operated by link-chains driven by individual 15-horsepower electric motors located beneath service bridge spans. Drawings M-L 25 40/2, M-L 24, 48A/1, M-L 24 55/1.
2. Lighting: Some fixtures extant from ca. 1940 installation. Others replaced and/or rewired.

E. Other Elements:

1. Earth dike: Linear, submersible 2,720-foot dike comprised of steel sheet pile cells with stone and earth fill, with concrete walkway along crest. Dike is located at east end of storage yard and extends eastward to the Illinois shore. Drawing M-L 24 52/2.
2. Tainter gate emergency bulkheads: Temporary blocking units of structural steel girder construction used to block gate openings during emergency or repairs.
3. Emergency bulkhead cars/tracks: Flatcars and tracks designed to facilitate handling and storage of temporary emergency bulkheads in storage yard. Drawing M-L 24 53/8.
4. Flatcar assembly: Flatcar associated with locomotive crane atop service bridge.
5. Locomotive crane: Rail-mounted gasoline-powered crane, replaced ca. 1980. Located atop service bridge and used to handle heavy equipment and emergency bulkheads. Original "F" type unit. Drawings M-L 24 40/2.
6. Storage yard: Located at east abutment of movable dam and incorporating Pier Nos. 16 and 17. Paved yard area measures 120 feet by 126 feet and contains three sets of tracks for bulkhead cars, a metal storage shed, and various spare parts, including the Tainter gate emergency bulkheads. Drawings M-L 24 40/1, M-L 2 53/8.
7. Boat Launch: Electrically-operated davits located at upper and lower ends of intermediate walls.

PART IV. TECHNOLOGICAL INFORMATION -- ESPLANADE AREA

A. Description of Esplanade -- General Layout:

1. Design character: Standardized park/service area component. Originally designed to accommodate the central control station and various service-related functions.
2. Historic landscape design: Based on standardized designs.

B. Condition of Site and Structures: Altered.

1. Central control station -- exterior: Standardized construction. Flat roof with parapet. Buff brick walls with precast stone trim, clad with stucco. Office addition attached to north facade. Drawing M-L 24 70/1.
 - a. First floor -- interior: Contains control room, with switchboard, offices, toilet room, and stairway access to loft and basement. Ceilings lowered and loft enclosed in 1976. Drawings M-L 24 70/2, M-L 24 70/3.
 - b. Basement -- interior: Single room used for storage. Drawings M-L 24 70/2, M-L 24 70/3.
2. Outbuildings: Various service buildings and sheds erected over time. None have particular significance or contribute to the character of the site. The shop and maintenance buildings, both erected in the early 1960s, are standardized designs.
3. Observation deck: Raised observation deck located north of central control station. Erected in 1958.

PART V. SOURCES OF INFORMATION

- A. Original architectural drawings: Construction drawings, Mississippi River Lock & Dam No. 24, half-size copies on file at St. Louis District Office. Additional copies, as well as additional assorted drawings, are on file at the site.
- B. Historic views: Construction photographs -- various views on file at site.
- C. Interviews: Personnel, Lock and Dam No. 24.
- D. Bibliography:
 1. Primary and unpublished sources: History and Cost Report, Lock No. 24, on file at the St. Louis District Office. Assorted files and records held at the site and at the St. Louis District Office. See bibliography to HAER No. MO-50, Narrative History.

2. Secondary and published sources: See bibliography to HAER No. MO-50, Narrative History.

E. Likely sources not yet investigated: National Archives, Record Group 77, Kansas City, Missouri. The holdings for the St. Louis District are presently unprocessed. A preliminary investigation of more than 50 boxes of material failed to yield any significant information on the Nine-Foot Channel Project. However, the processed records will be much easier to use and may provide additional data.

F. Supplemental Material: Aerial Photographs, U.S. Army Corps of Engineers, St. Louis District.

LOCK AND DAM NOS. 24 THROUGH 27 -- INDIVIDUAL SIGNIFICANCE AND INVENTORIES

This report is part of the documentation that outlines the specific technological component of each lock and dam complex, with particular emphasis upon significant and unique engineering elements. Additions and alterations to the various components comprising the individual complexes are also described in this documentation. The principal sources for information pertaining to these additions and alterations are the engineering drawings prepared for individual projects and the detailed repair and maintenance records held at each site. These sources do not comprehensively document the myriad changes, many of a decidedly superficial nature, made to each complex since its construction. Nevertheless, they constitute the only available record of these changes.

Dates for the construction of each complex are given from the onset of work to the completion of the complex and do not necessarily reflect the construction dates for any single element of the installation. Final construction reports survive for Lock and Dam No. 26, Lock No. 25, and Lock No. 24. These reports, held either at the individual sites or at the St. Louis District Office of the Corps of Engineers, concentrate almost exclusively on the actual construction process. The final construction reports include comprehensive lists of contractors and material suppliers, but contain only limited information pertaining to design, project administration, politics, and environmental issues.

Dimensions for the movable gate sections have been rounded, in accordance with common contemporary practice. For example, roller gates that measure 88 feet 10-1/2 inches in length are identified in construction drawings, completion reports, photographs, and this report, as 80-foot gates. Therefore, all gate measurements should be considered approximate rather than absolute.

Users of this documentation should note that, although many of the complexes appear identical, some architectural and engineering components vary significantly between complexes. This variation is most obvious in the disparity between the appearance of the three installations, Lock and Dam Nos. 24-26, constructed during the 1930s, with Lock and Dam Nos. 26R and 27, constructed after World War II. However, there are subtle variations in the design of gate piers, gates, control stations, and other elements at each of the three 1930s installations. These variations largely reflect improvements in engineering practice that permitted the elimination of structurally unnecessary material. The open design of the Tainter gate piers at Dam No. 24, as contrasted with the more massive, monolithic design at the earlier Dam No. 26, provides perhaps the most obvious example of this type of variation. A fuller discussion of the architectural and engineering evolution of the St. Louis District installations is included within the narrative history portion of this documentation.